ARM IN REST POSITION

FIG. 1A

ARM DEFORMED
NEGATIVELY USING
SIX INDIVIDUAL SCALE
CONTROLS. NOTE
THAT USING THE
SINGLE CONTROLS
CAUSES LOSS OF
VOLUME IN THE ARM
AT THE ELBOW.

FIG. 1B

ARM DEFORMED
POSITIVELY USING SIX
INDIVIDUAL SCALE
CONTROLS. NOTE
THAT USING THE
SINGLE CONTROLS
CAUSE LOSS OF
VOLUME IN THE ARM,
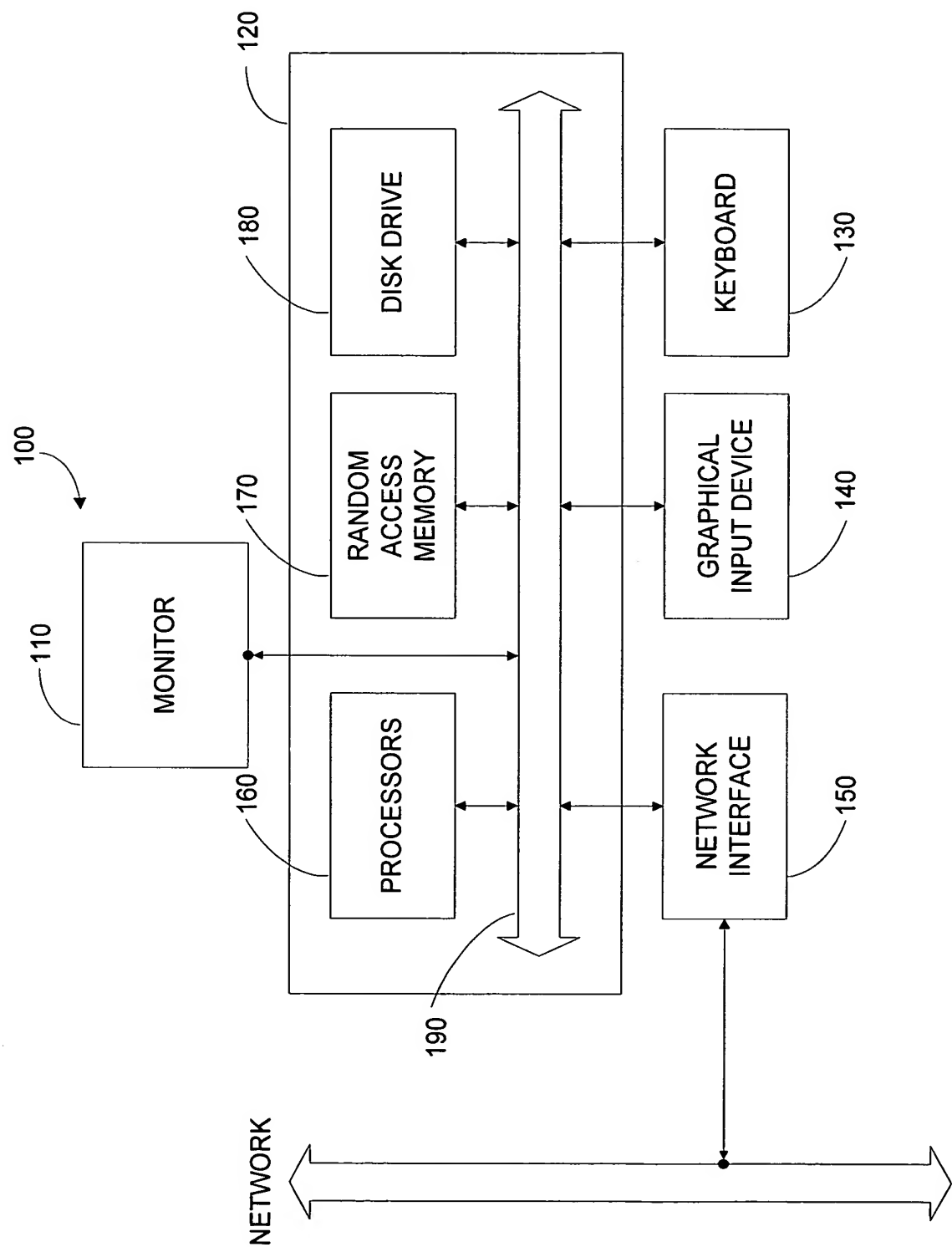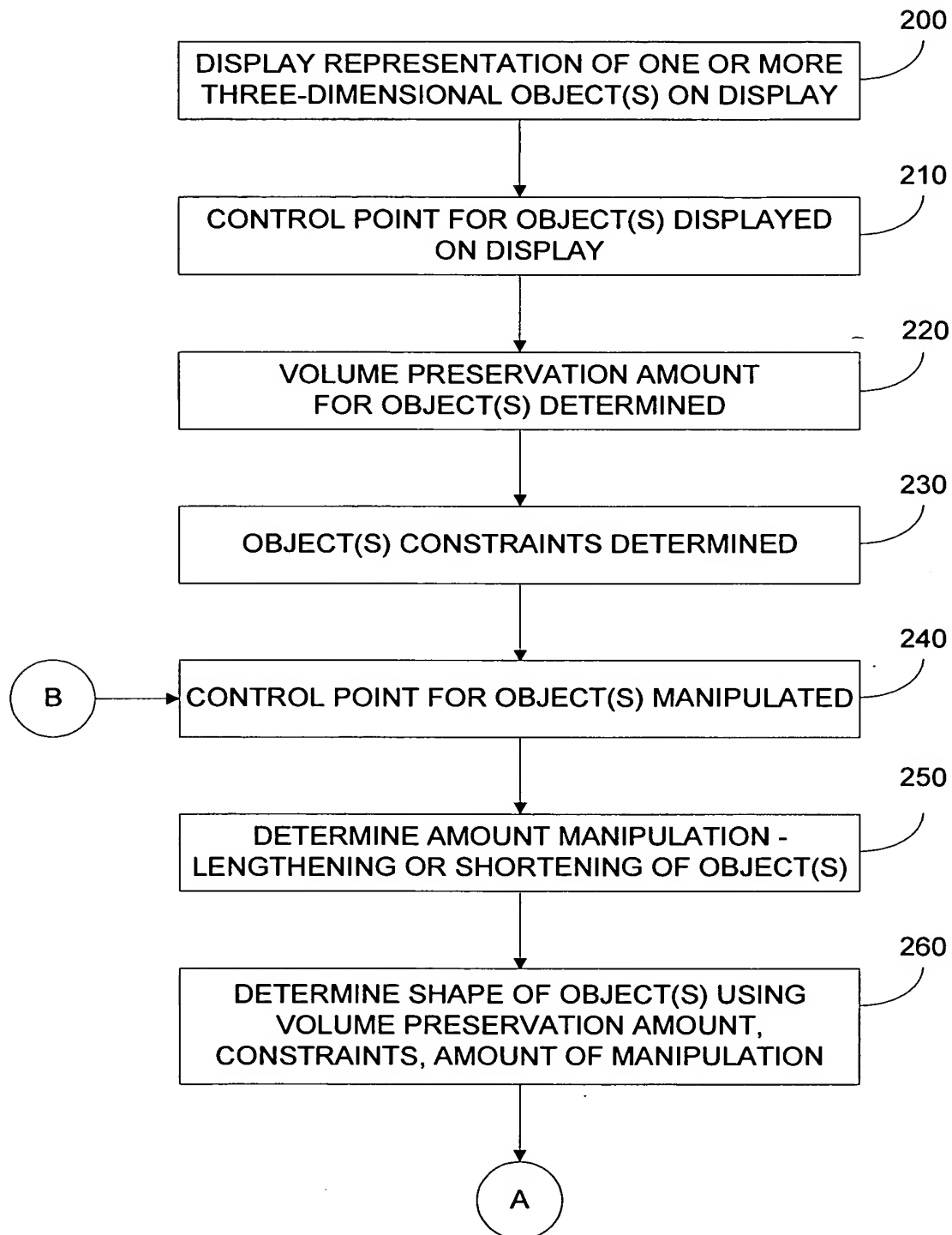UNDESIRED BULGING
AT THE ELBOW .

FIG. 1C

PRIOR ART

FIG. 2
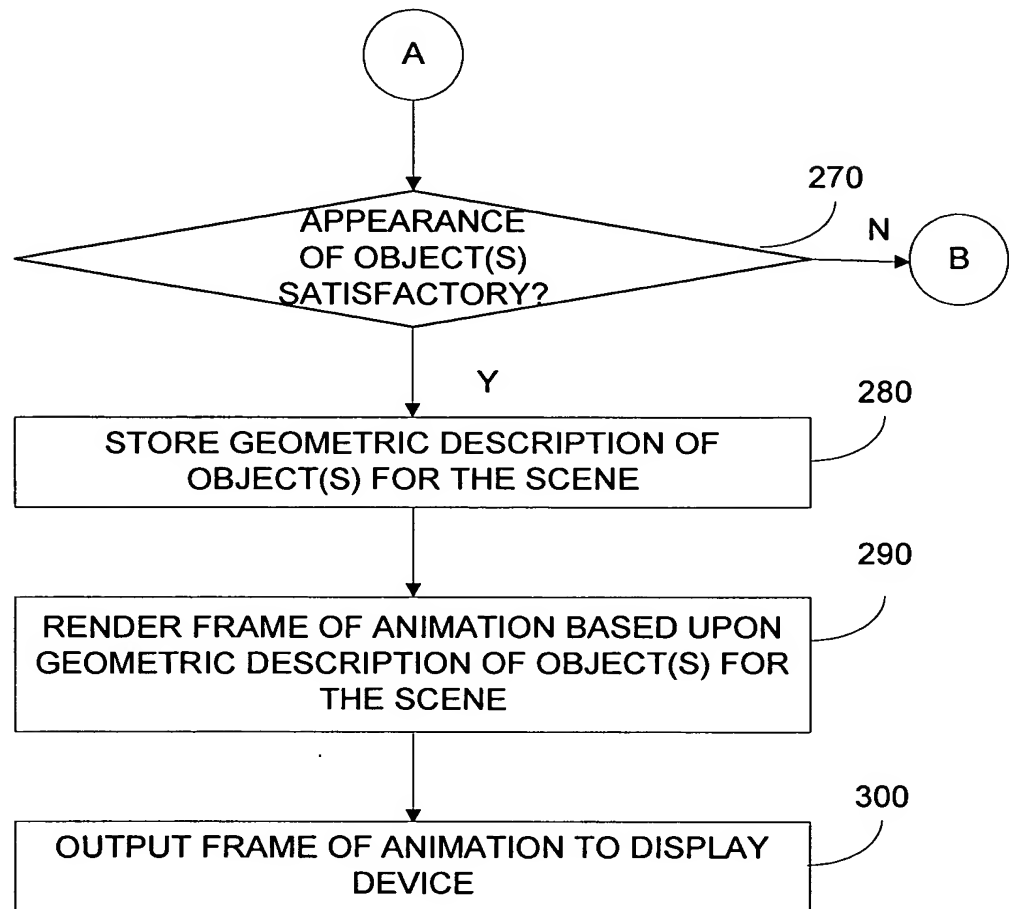
200

DISPLAY REPRESENTATION OF ONE OR MORE
THREE-DIMENSIONAL OBJECT(S) ON DISPLAY

210

CONTROL POINT FOR OBJECT(S) DISPLAYED
ON DISPLAY

220

VOLUME PRESERVATION AMOUNT
FOR OBJECT(S) DETERMINED

230

OBJECT(S) CONSTRAINTS DETERMINED

240

B

CONTROL POINT FOR OBJECT(S) MANIPULATED

250

DETERMINE AMOUNT MANIPULATION -
LENGTHENING OR SHORTENING OF OBJECT(S)

260

DETERMINE SHAPE OF OBJECT(S) USING
VOLUME PRESERVATION AMOUNT,
CONSTRAINTS, AMOUNT OF MANIPULATION

A

FIG. 3A

A

APPEARANCE
OF OBJECT(S)
SATISFACTORY?   270   N   B

Y

STORE GEOMETRIC DESCRIPTION OF
OBJECT(S) FOR THE SCENE   280

RENDER FRAME OF ANIMATION BASED UPON
GEOMETRIC DESCRIPTION OF OBJECT(S) FOR
THE SCENE   290

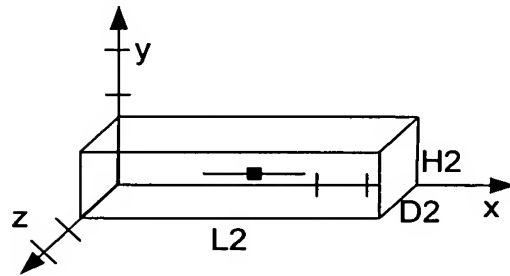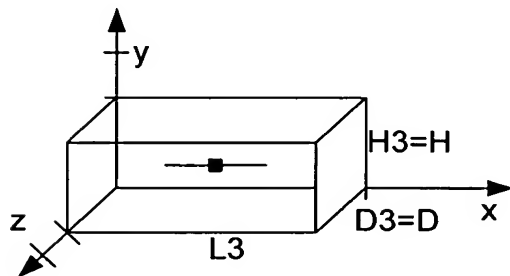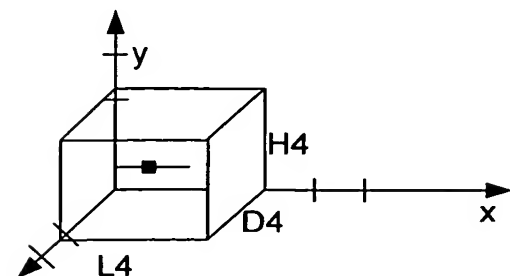OUTPUT FRAME OF ANIMATION TO DISPLAY
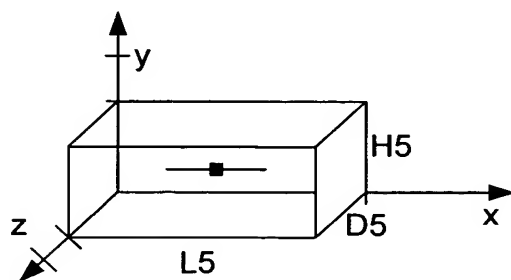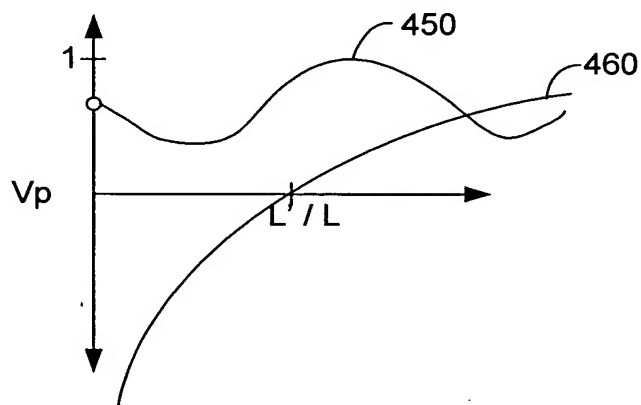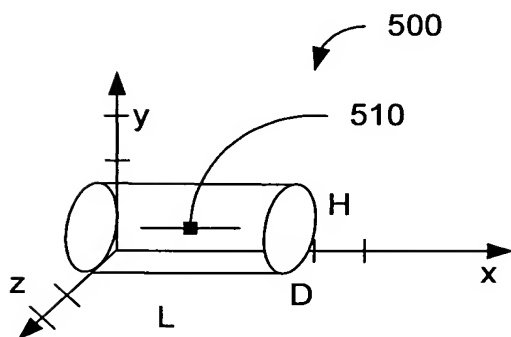DEVICE   300

FIG. 3B
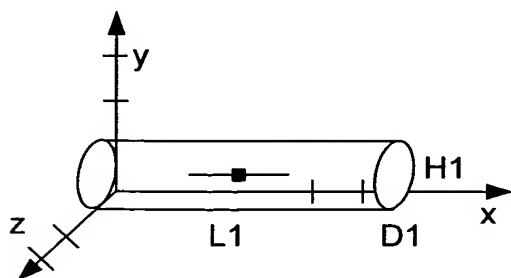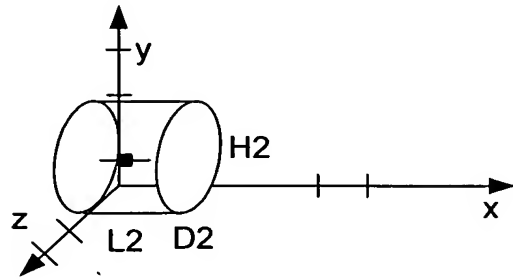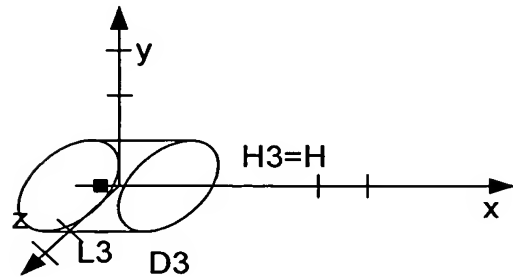
FIG. 4A

FIG. 4B
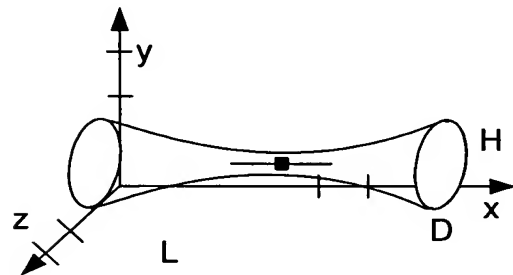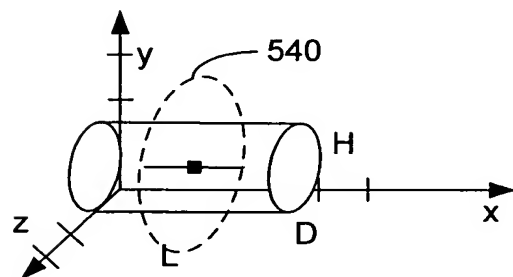
FIG. 4C

FIG. 4D

FIG. 4E

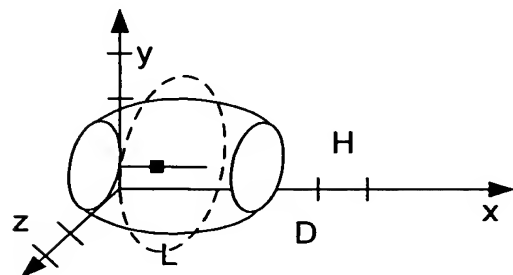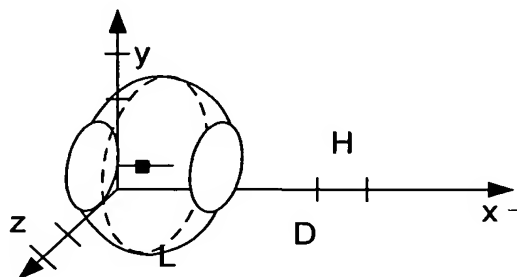FIG. 4F

FIG. 4G

FIG. 5A

FIG. 5B

FIG. 5C

FIG. 5D

FIG. 5E

FIG. 5F
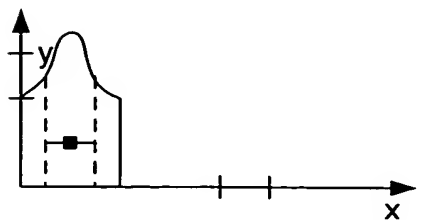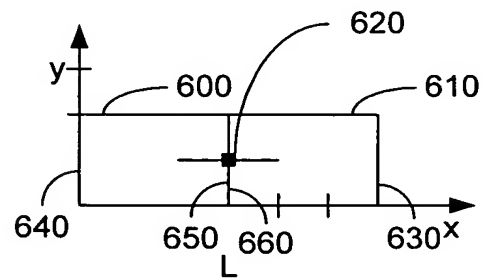
FIG. 5G1

FIG. 5G2

FIG. 5G3
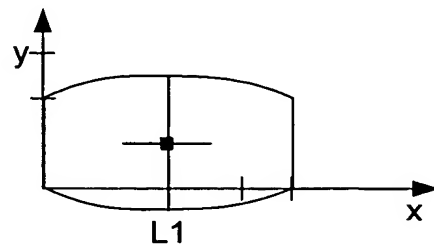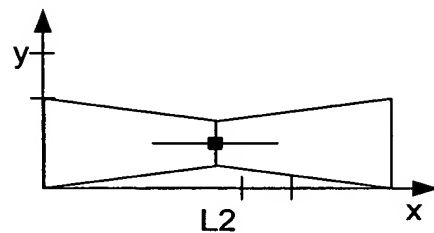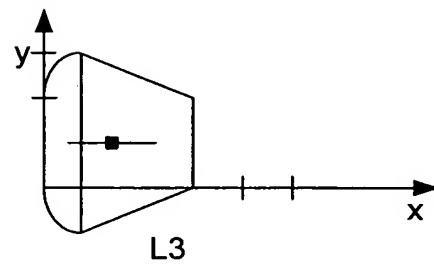
FIG. 5G4

FIG. 5H

FIG. 6A
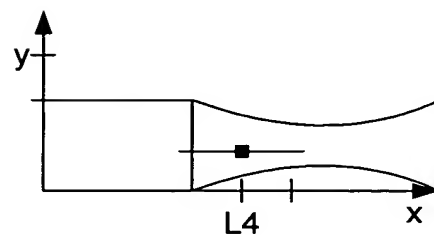
FIG. 6B

FIG. 6C

FIG. 6D

FIG. 6E

ARM AT REST WITH THE SQUASH AND STRETCH
WIDGET DISPLAYED. TO MOVE THE ARM, THE
ANIMATOR GRABS THE CUBE MANIPULATOR AND
DRAGS IT EITHER IN THE POSITIVE OR NEGATIVE
DIRECTION TO DEFORM THE ARM

FIG. 7A

ARM DEFORMED WITH
SQUASH AND
STRETCH WIDGET IN
THE NEGATIVE
DIRECTION. NOTICE
THAT THERE IS
VOLUME
PRESERVATION
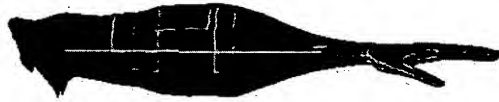ACROSS THE UPPER
ARM AND FOREARM.

FIG. 7B

ARM DEFORMED WITH
SQUASH AND
STRETCH WIDGET IN
THE POSITIVE
DIRECTION. NOTICE
THE SMOOTH
TRANSITION BETWEEN
THE UPPER ARM AND
LOWER ARM.

FIG. 7C